

REMARKS

Claims 16-18, 22-28 and 30-39 are pending. Reconsideration of the Office Action and allowance of the present application and all the claims therein are respectfully requested and now believed to be appropriate.

Rejection Under 35 U.S.C. § 103(a)

Claims 16-18, 22-28 and 30-39 were rejected under 35 U.S.C. §103(a) over Applicant's Admitted Prior Art in view of U.S. Patent No. 6,200,836 to YOO. This rejection is respectfully traversed.

While acknowledging that AAPA lacks, among other things, ion implanting an interstitial element onto the source and drain extension regions and forming low-vacancy regions that substantially overlap the source and drain extension regions, the Examiner nevertheless asserts that YOO teaches the former feature, that the latter feature is inherent based on the combination of these teachings, and that it would have been obvious to combine the teachings of AAPA and YOO in order to render the claimed invention unpatentable.

Applicants submit that the Examiner has failed to set forth a *prima facie* case of unpatentability because no proper combination of AAPA and YOO disclose or suggest at least the following features:

Independent claim 16 recites, among other things:

ion implanting an interstitial element into the source and drain extension regions to reduce vacancy concentration in the source and drain

extension regions and to form low-vacancy regions that substantially overlap the source and drain extension regions.

Furthermore, independent claim 38 recites, among other things:

forming sidewalls on sides of the gate electrode; and
ion implanting an interstitial element into the source and drain extension regions to reduce vacancy concentration in the source and drain extension regions,
wherein the ion implanting occurs after the sidewalls are formed.

Finally, independent claim 39 recites, among other things:

forming sidewalls on sides of the gate electrode;
reducing a vacancy concentration in the source and drain extension regions using ion implantation in order to annihilate excess vacancies or trap vacancies,
wherein the reducing occurs after the sidewalls are formed and forms low-vacancy regions that substantially overlap the source and drain extension regions.

Applicants acknowledge that YOO discloses implanting oxygen 30 to the regions 16 and 18 in order to form oxide layers 38 and source and drain regions 32 (see Figs. 2 and 3). However, in addition to failing to disclose the recited SiGe substrate (col. 3, line 44 of YOO explains only that layer 12 is a gate oxide), Applicants submit that YOO also fails to disclose, or even suggest, ion implanting an interstitial element into the source and drain extension regions to reduce vacancy concentration in the source and drain extension regions and to form low-vacancy regions that substantially overlap the source and drain extension regions. To the contrary, Fig. 2 of YOO shows that the oxygen implantation is focused onto only a tiny portion of the regions 16 and 18. Furthermore, Fig. 3 shows that the resulting barrier 38 only overlaps, if at all, a small portion of the

source/drain regions 32. As such, YOO clearly fails to specifically disclose that the oxygen implantation 30 forms low-vacancy regions that substantially overlap the source and drain extension regions (claims 16 and 39), that is, that overlap nearly all of the source and drain regions 32, much less, source/drain extension regions 34 and 36.

Furthermore, because YOO discloses that the oxygen implantation occurs at an angle of between 30 and 60 degrees (see col. 4, line 4-7) and at a dose that is only in the range of 1×10^{12} to 1×10^{13} atoms/cm³ (see col. 4, lines 1-4), it is not apparent that such an implantation step would result in the formation of low-vacancy regions that substantially overlap the source and drain extension regions. Applicants remind the Examiner that the ion implantation of the invention occurs at higher concentrations such as, e.g., 1×10^{14} to 1×10^{16} atoms/cm², that Fig. 4 of the instant application clearly shows that the ion implantation B occurs over most of the source/drain extension regions 24, and that, as a result, the low-vacancy regions 26 substantially overlap the source and drain extension regions 24.

Applicants also acknowledge that YOO discloses, in addition to the implantation step shown in Fig. 2, the step of forming the sidewalls 33 (see Fig. 3). However, it is clear from the description of Figs. 2 and 3, as well as the drawings themselves, that the oxygen implantation 30 occurs before the sidewalls 33 are formed. Claim 38, on the other hand, recites that the ion implanting occurs after the sidewalls are formed. Furthermore, the Examiner has failed to identified any disclosure in YOO which discloses or suggest that the steps shown Figs. 2 and 3 of YOO (which clearly show that the ion implanting occurs before the sidewalls are formed) could be reversed.

As such, YOO simply cannot cure the noted deficiencies of AAPA (even assuming the Examiner's characterization of the AAPA is correct - which Applicants' dispute). Again, YOO clearly fails to disclose, or even suggest, that the disclosed implanting of oxygen is suggestive of ion implanting an interstitial element into the source and drain extension regions to reduce vacancy concentration in the source and drain extension regions and to form low-vacancy regions that substantially overlap the source and drain extension regions and/or that that the ion implanting occurs after the sidewalls are formed. Again, the actual disclosure of YOO teaches away from these features by implanting oxygen to only a portion of the regions 32 and by performing the implantation before the sidewalls are formed.

Finally, Applicants take issue with the Examiner's assertions that the resulting low-vacancy regions formed by the combination of AAPA and YOO "would inherently and substantially overlap the source and drain extension regions." Such assertions are entirely unsupported by the disclosure of the applied prior art. As explained above, YOO merely discloses that the oxygen implantation occurs at an angle of between 30 and 60 degrees (see col. 4, line 4-7) and at a dose that is only in the range of 1×10^{12} to 1×10^{13} atoms/cm³ (see col. 4, lines 1-4). Moreover, Fig. 3 shows that the implantation results only in "a firm barrier 38" formed in regions 32. The invention, on the other hand, provides that the ion implantation occurs at higher concentrations such as, e.g., 1×10^{14} to 1×10^{16} atoms/cm². Moreover, Fig. 4 of the instant application clearly shows that the ion implantation B is focused over most of the regions 24 rather than only a portion of regions 16 and 18 (see Fig. 2 of YOO). Finally, whereas the invention results

in the low-vacancy regions 26 substantially overlapping the source and drain extension regions 24, the steps shown in Figs. 2 and 3 of YOO result in "oxide layers 38 at the interface between the source/drain regions 32 and the surrounding silicon substrate" (emphasis added). Thus, it is not inherent from the disclosure of YOO that such an implantation step would result the formation of low-vacancy regions that substantially overlap the source and drain extension regions.

Thus, Applicants submit that no proper combination of these disclosures discloses or suggests at least the features recited in claims 16, 38 and 39, and claims 17, 18 and 22-28 and 30-39, which depends therefrom.

Accordingly, Applicants respectfully submit that the rejection under 35 U.S.C. § 103(a) should be withdrawn.

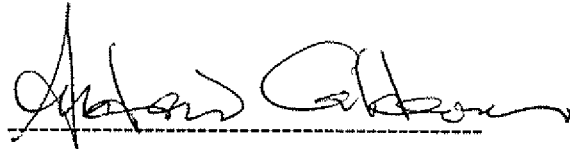
CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicants hereby make a written conditional petition for extension of time, if required.

P27374.A08

Please charge any deficiencies in fees and credit any overpayment of fees to
Deposit Account No. 09-0458.

Respectfully submitted,
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A handwritten signature in black ink, appearing to read "Andrew Calderon", written over a horizontal dashed line.

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